USG Proceedings Journal

Meeting Abstracts | Open Access

Proceedings of the 3rd Global Conference on Environmental Science and Technology (GEST - 2026)

Multiomics-based Health-impact Assessment of Environmental Contaminants and Management Approaches for Treatment of Wastewater for the Benefit of Our Environment and Communities

Hamid R. Habibi*

Department of Biological Sciences, University of Calgary, Calgary, Canada

Abstract

Over the past three decades, our research has applied multiomics approaches, including transcriptomics and other molecular tools, alongside environmental monitoring, and biological markers to characterize environmental contaminants in rivers across southern Alberta, Canada. These studies have identified mechanistic links between contaminant exposure and adverse health outcomes affecting reproduction, growth, development, metabolism, obesity, neurodevelopment, and ecosystem health. Multiomics analyses have revealed novel molecular pathways and biological endpoints, providing deeper insight into how environmental pollutants disrupt energy metabolism, reproductive processes, and neural stem cell development, including pathways associated with hyperactivity. By integrating multi-omics data with ecological and health assessments, our work advances the understanding of contaminant impacts on both wildlife and human populations. Building on these mechanistic insights, we are collaborating with municipal partners to improve wastewater treatment technologies and management strategies that reduce contaminant release into aquatic environments. Current efforts focus on developing innovative wastewater remediation approaches and implementing real-time monitoring of chemical pollutants and infectious agents in the City of Calgary, with the goal of protecting ecosystems, supporting community health, and promoting sustainable water management.

Novel Gas-phase Biorefineries for Biological Carbon Upcycling

Raul Munoz Torre*

University of Valladolid, Valladolid, Spain

Abstract

The growing awareness of the need to reduce dependence on fossil fuels to mitigate climate change, particularly to decarbonize the transport sector, has driven global biogas and biomethane production over the past decade. Although membrane separation has gained a significant market share in the biogas upgrading sector over the past five years, research into biological methods for the removal of carbon dioxide, hydrogen sulfide, and siloxanes has also attracted considerable attention. In this context, hydrogenotrophic biogas upgrading has undergone substantial advances, leading to the development of novel process configurations, improved understanding of the underlying process microbiology, and significant progress in technology validation at pilot scale. The anticipated large-scale production of hydrogen from renewable energy sources is expected to further accelerate the deployment of this biogas upgrading technology. Similarly, photosynthetic biogas upgrading in algal-bacterial photobioreactors has been optimized and validated at pilot and demonstration scales, enabling the simultaneous recovery of nitrogen and phosphorus from digestate. Furthermore, biogas has recently been investigated as a feedstock for the biotechnological production of commodity products (e.g., biopolymers and proteins) and high-value-added compounds (e.g., ectoine), opening up new opportunities for biogas valorization. The main limitation of this emerging biorefinery concept lies in the low aqueous solubility of methane, which necessitates the validation of high-performance gas-phase bioreactors. Finally, the solid fraction of digestate can be converted through gasification into carbon dioxide, carbon monoxide, and hydrogen gas, which can subsequently be biologically transformed into methane, ethanol, or acetic acid under anaerobic conditions. The latter can be further bioconverted into butyric acid, butanol, caproic acid, or hexanol through anaerobic chain elongation.

Influence of the Relative Humidity on the Moisture Content and the Flow Properties of Dry Sorption Powders

Christof Lanzerstorfer*

University of Applied Sciences Upper Austria, Austria

Abstract

Dry sorption, particularly via injection of dry sorbents into the flue gas stream, is a key technology in modern off-gas cleaning systems. It is widely applied for the removal of acidic gases such as hydrochloric acid, hydrofluoric acid, and sulfur dioxide through heterogeneous gas–solid reactions with alkaline sorbents. In addition, dry sorption is highly effective for mitigating trace pollutants, including polychlorinated dibenzo-p-dioxins and dibenzofurans and mercury, by adsorption on carbonaceous or mineral sorbents. Effective performance of dry sorption systems strongly depends on flue gas temperature, which must be kept below specific limits to enhance reaction kinetics and adsorption efficiency. The sorbents are removed from the flue gas stream in a downstream gas cleaning filter and discharged from the filter hopper via mechanical conveying systems. The flowability of the sorbents is a critical parameter for the reliable operation of these transport systems. At low flue gas temperatures, a constant absolute moisture content in the gas results in an increase in relative humidity, which negatively affects the flowability of the sorbent materials. Elevated relative humidity promotes moisture uptake, particle agglomeration, and adhesion effects, leading to impaired material handling. In this study, the flowability of four industrially applied sorbents was investigated as a function of relative air humidity. For all sorbents examined, a pronounced deterioration in flowability was observed at relative humidities exceeding 90%. These results highlight the importance of controlling temperature in filter hoppers to ensure stable sorbent handling and reliable operation of dry sorption systems.

Climate Change and Vegetation-based Adaptation Priorities in Akçakoca, Türkiye

Nermin Başaran* and Sertaç Kaya

Düzce University, Türkiye

Abstract

Climate change poses challenges for coastal vegetation and urban green infrastructure. This study evaluates climate projections for Akçakoca, a district on Türkiye's western Black Sea coast, to identify vegetation-based adaptation priorities. Climate maps and district-level summaries presented for current conditions and 2040 - 2060 under shared socioeconomic pathway 5 - 8.5 were compared for mean annual temperature and annual precipitation. Provincial moisture classes were assessed using the De Martonne index. These existing climate results were interpreted in relation to Akçakoca's forest, coastal, agricultural and urban landscapes; vegetation change and ecosystem service responses were not directly measured. The presented Akçakoca summaries indicate an increase in mean annual temperature from 13.7 to 17.1 °C and a decrease in annual precipitation from 1,047 to 1,012 mm. At the Düzce provincial scale, 38% of the area is projected to be semi-humid in 2040 - 2060 under shared socioeconomic pathway 5 - 8.5. These findings support monitoring moisture-dependent plant communities and maintaining connected forest and coastal vegetation, particularly at settlement–agriculture–forest transitions. Integrating the climate projections with field observations and spatial vegetation data is necessary to identify site-level ecological risks and evaluate adaptation priorities.

Nature Based Solutions Vis-a-vis Three-eyed Seeing: Indigenous People's Responsibility for Our Relations

Myrle Ballard*

University of Calgary, Canada

Abstract

This talk explores how we can understand the precepts of indigenous people and their responsibilities to our relations. Nature based solutions is a term that is widely used and accepted in international forums, however, for indigenous people, the term "nature-based" does not resonate with the lived experiences and responsibilities as stewards of lands. Many indigenous people grow up on "the land" and they are "one" with the land and not separate, whereas non-indigenous people tend to refer to "nature" as a means of re-connection and place of refuge. From this precept, this talk will explore "three-eyed seeing" which is a framework for our relations, indigenous science, and western science in working with the three lenses. Our relations is a relational concept of the relationship between indigenous people and those who cannot speak for themselves – our relations – which are the winged, two- four-legged, finned, crawling, including animate, and inanimate. The talk explores a critical lens of

understanding how indigenous science a useful and important tool is in understanding our relations and how we can listen to what they are saying to make better informed decisions.

DEKRA Climate Impact Program: An Innovative Approach for Alternative Corporate Climate Responsibility

Ruben von Ristok*

DEKRA Group, DEKRA e.V., Germany

Abstract

The DEKRA Climate Impact Program is a strategic, impact-oriented framework designed to advance corporate climate responsibility beyond conventional carbon offsetting. Instead of maintaining claims of accounting-based carbon neutrality through the purchase of external carbon credits, the program prioritizes measurable emission reductions and verifiable climate and societal impact. Central to the DEKRA Climate Impact Program is a dual approach that combines internal decarbonization and transition planning with targeted external investments in climate change mitigation and adaptation. Internally, DEKRA (a global independent testing, inspection, certification organization) applies a science-based decarbonization pathway aligned with the 1.5 °C-target of the Paris agreement and validated by the science based targets initiative. A binding internal carbon pricing mechanism integrates the cost of greenhouse gas emissions into managerial decision-making and accelerates emissions reductions across relevant scopes. A fixed amount per ton of this internal carbon price is used externally for real impact through carefully selected partner projects in areas such as ecosystem restoration, climate resilience, and access to essential resources, rather than being neutralized in corporate carbon accounting. Current partners of the program are, for example, United Nations Children's Fund and World Wide Fund. Furthermore, DEKRA strives to invest in innovative green research and technology in the future, such as carbon capture, utilization and storage. The effectiveness of all activities is systematically assessed using the United Nations sustainable development goals as a transparent impact measurement framework. By explicitly rejecting offset-based neutrality claims and emphasizing real-world outcomes, the program establishes a credible model for long-term, science-aligned corporate climate responsibility and resilience.

Letting the Land Tell Us What It Needs: Indigenous Science and 3-eyed Seeing in Indigenous - Led Research on Regenerative Forestry and Environmental Stress in Canada

Gavin Woodburn* and Dr. Myrle Ballard*

University of Calgary, Calgary, Canada

Abstract

This talk will explore the vital role of indigenous science and 3-eyed seeing in approaching environmental challenges. It will explain how indigenous-led research is explicitly distinct from Western scientific processes and emphasize the need for proper protocol when working with communities that have a deep connection to the land. This talk will draw from two case studies: 1) Kwiakah First Nation-led regenerative forestry in the Pacific Northwest, and 2) Lake St. Martin First Nation-led research on flood impacts and environmental change in central Canada. These distinct settings and people share a similar story of being ignored in decision-making that negatively affects their lands, but also a story of how these communities can once again play a central role in healing their lands. Through proper protocol grounded in indigenous governance and self-determination, free prior and informed consent, and ownership control accessibility and possession, we can weave together Western and indigenous science to create a more relational approach to these challenges. This presentation will explore how bridging, braiding, and weaving our collective knowledge, while also using the lens of our relations, can give us the ability to create dynamic and sustainable solutions for the land and its people. These solutions are always specific to place and involve cultural revitalization, building capacity within community, and new innovative research with practical application.

Digital Decision Support System for Environmentally-friendly Agriculture EnviAgri

Lidia Dzierzbicka-Głowacka[1*], Dawid Dybowski[1], Artur Nowicki[1], Jan Jadczyszyn[2], Stefan Pietrzak[3], Tamara Jadczyszyn[2] and Aleksander Mach[4]

[1]*Institute of Oceanology Polish Academy of Sciences, Sopot, Poland*

[2]*Institute of Soil Science and Plant Cultivation – State Research Institute, Puławy, Poland*

[3]*Institute of Technology and Life Sciences - State Research Institute, Falenty, Poland*

[4]*Pomeranian Agricultural Advisory Centre, Lubań, Poland*

Abstract

The EnviAgri project aims to develop a digital decision support system that assists farmers in meeting regulatory requirements while optimizing resource use and reducing environmental impacts. The core of the system is the digital farm model, which combines expert knowledge with user-provided farm data and external environmental parameters. Through an interactive interface, the model links site-specific information with meteorological data, soil characteristics, and regional regulatory frameworks. The computational module is composed of eight specialized submodules that assess critical environmental and economic indicators:

- Nutrient balance assessment based on updated nitrogen and phosphorus content in fertilizers and agricultural products.
- Estimation of nitrate leaching using an empirical model adapted to polish soil-climatic conditions.
- Phosphorus loss risk evaluation through erosion and runoff potential analysis.
- Ammonia emission calculation in accordance with established methodologies.
- Greenhouse gas emissions assessment following intergovernmental panel on climate change guidelines.
- Soil organic matter balance estimation for sustainable soil management.
- Drought risk analysis integrating real-time and forecasted climatic water balance data.
- Economic indicators computation for crop and livestock production at the farm level.

Each submodule employs tailored algorithms to generate actionable outputs. Farmers receive clear recommendations to reduce emissions, enhance soil fertility, and increase overall resource efficiency. By identifying areas particularly vulnerable to nutrient loss and energy inefficiencies, the system supports strategic decision-making that balances environmental sustainability with farm profitability.

Tailoring Conductive Magnéli Titanium Suboxide Through Hydrothermal Transition Metal Doping

Maja Rankovic[1*], Tijana Milivojevid[2], Nemanja Gavrilov[1], Bojana Nedid Vasiljevid[1], Danica Bajuk-Bogdanovid[1] and Maja Milojevid-Rakid[1]

[1]*Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia*

[2]*Centre for Ecotoxicological Research, Podgorica, Montenegro*

Abstract

Magnéli phase titanium suboxides are a class of materials that exhibit high electrical conductivity and excellent chemical and thermal stability, making them highly attractive for applications in catalysis, electrochemistry, energy storage, and environmental protection, and offering advantages over conventional carbon-based and noble metal electrodes in terms of cost, durability, and corrosion resistance. Transition metal doping can significantly modify the electronic structure and surface properties of titanium sub-oxides, leading to enhanced charge transport, redox behavior, and catalytic activity. The Magnéli phase titanium suboxide was synthesized from titanium dioxide. powder through a controlled thermal process at 950 °C under a reducing argon/hydrogen atmosphere. After formation of the Magnéli phase, cobalt and iron were introduced through hydrothermal treatment to modify the structural, electronic, and surface properties of titanium suboxide. The doped materials were subjected to an additional thermal treatment at 950 °C in order to improve crystallinity, phase stability, and dopant distribution within the titanium oxide lattice. The characterization of the obtained materials enabled a detailed evaluation of their structural and surface properties. X-ray diffraction analysis combined with Rietveld refinement confirmed the successful formation of the titanium suboxide and allowed detailed evaluation of its crystallographic structure, phase composition, and structural parameters. Furthermore,

X-ray photoelectron spectroscopy analysis provided detailed insight into the surface chemical composition and oxidation states of titanium, cobalt, iron, and oxygen species in the doped materials. The obtained cobalt - and iron - doped titanium suboxide materials represent promising materials for electrochemical, catalytic, and environmental applications due to their enhanced conductivity and tunable physicochemical properties.

Multi-source Pollution in a Mining-impacted Mediterranean Ramsar Site

Rosa Ana Pérez[1*], María del Mar Gil-Díaz[2], Juan Alonso[2], Carolina Mancho[2], Sergio Díez-Pascual[2], Beatriz Albero[1] and María del Carmen Lobo[2]

[1]Department of Environment and Agronomy, National Institute for Agricultural and Food Research and Technology, Spanish National Research Council, Madrid, Spain

[2]Department of Agroenvironmental Research, Madrid Institute for Rural, Agricultural and Food Research and Development, Madrid, Spain

Abstract

The southwestern Iberian Peninsula hosts the Iberian Pyrite Belt, one of the most extensive sulfide mineral provinces globally, with a mining history extending from ancient times through the late 1900s. This prolonged activity has generated abundant waste and numerous abandoned sites, particularly in the province of Huelva. Large pyrite concentrate deposits were historically placed along the margins of the Odiel salt marshes, a Ramsar-protected wetland and Unesco biosphere reserve. The oxidation of sulfide minerals produces acidity, lowering pH and increasing metal mobility, while additional industrial activities have further contributed to a complex contamination setting. Despite its environmental importance, a comprehensive characterization of this brownfield site remains incomplete. This study presents a preliminary assessment focused on total concentration and bioavailability of contaminants. Six composite soil samples were collected and characterized physiochemically, including total concentrations of 12 metal(loid)s and 34 organic contaminants. Metal(loid) and organic contaminant availability was assessed using the toxicity characteristic leaching procedure method and the standard extraction method DIN 38414, respectively. Results reveal that the soil is extremely acidic (pH 1.9 - 4.8) and highly saline (>8 decisiemens per meter), with variable concentrations of arsenic, cadmium, cobalt, chromium, copper, mercury, nickel, lead, and zinc, as well as polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and organophosphates. In terms of bioavailability, copper, zinc, and organophosphates were the most significant contaminants. These findings provide a solid basis for future risk assessment and the design of effective remediation strategies. This dataset supports improved environmental management and prioritization of remediation actions in contaminated wetlands.

Linking Chemical Contamination and Ecotoxicological Responses in Mining Impacted Sediments Near Odiel Marsh (Southwest Spain)

María Dolores Fernández[1*], Rosa Ana Pérez[1], María Carmen Lobo[2], Pilar Sandín-España[3], Beatriz Albero[1], María del Mar Gil-Diaz[2], María Cobos-Escudero[3] and Concepción García-Gomez[1]

[1]Department of Environment and Agronomy, National Institute for Agricultural and Food Research and Technology, Spanish National Research Council, Madrid, Spain

[2]Department of Agroenvironmental Research, Madrid Institute for Rural, Agricultural and Food Research and Development, Madrid, Spain

[3]Unit of Plant Protection, INIACSIC, Madrid, Spain

Abstract

Mining activities are a major source of environmental contamination due to the release of toxic metal(loid)s that persist in ecosystems and threaten environmental and human health. In addition to inorganic pollutants, mining areas are often affected by organic contaminants, such as polycyclic aromatic hydrocarbons and polychlorinated biphenyls, characterized by their persistence, toxicity and accumulation potential. This study evaluated the ecological risk associated with metal(loid)s and organic contaminants in sediments from Aljaraque (Huelva, Spain), near the Odiel Marshes Natural Park, by relating chemical contamination with ecotoxicological responses. Sediments from six representative zones were analyzed for fourteen metals, sixteen priority polycyclic aromatic hydrocarbons, and seven polychlorinated biphenyls congeners. The toxicity of aqueous (DIN 38414) and organic (Ethyl acetate:methanol, 80:20 v/v) extracts was assessed using *Daphnia magna* (Immobilization test, OCDE, 2004) and *Vibrio fischeri* (Microtox® acute toxicity test). Sediments showed very acidic pH values and high electrical conductivity. High concentrations of metal(loid)s, primarily zinc, arsenic, lead, copper, and manganese were detected. Total

polycyclic aromatic hydrocarbon concentrations ranged from 269 to 1,192 µg/kg, with 3- and 4-ring compounds dominating. The sum of polychlorinated biphenyls concentrations ranged from 10 to 283 µg/kg, with one hotspot reaching 47.5 mg/kg. Toxicity tests revealed strong toxic effects in both aqueous and organic extracts. *D. magna* showed greater sensitivity (4.6-3500 TU) than *V. fischeri* (3.2 - 130 TU). Toxicity in aqueous extracts correlated with cadmium, nickel, zinc, copper, and cobalt concentrations, whereas no clear relationship was observed between toxicity and organic contaminants.

New Strategy for Assessment of Ozone Levels and Impacts on Mediterranean Forest Ecosystems

Tamara Jakovljević[1*], Lukrecija Butorac[2], Ivan Seletković[1], Nenad Potočić[1], Jasnica Medak[1], Ivan Limić[2], Alessandra De Marco[3] and Yasutomo Hoshika[4]

[1]*Croatian Forest Research Institute, Jastrebarsko, Croatia*

[2]*Institute for Adriatic Crops and Karst Reclamation, Split, Croatia*

[3]*ENEA Casaccia Research, Rome, Italy*

[4]*National Research Council -Research Institute on Terrestrial Ecosystems, Sesto Fiorentino, Italy*

Abstract

Climate change and air pollution are two significant interacting stressors affecting forest biodiversity and the sustainable management of European Union forests. One of the most important threats is tropospheric ozone (O_3). Current O_3 levels are high enough to negatively affect trees by inducing e.g., visible leaf symptoms, decreasing foliar chlorophyll content, accelerating leaf senescence, decreasing photosynthesis, growth, and carbon sequestration. The highest levels of O_3 were recorded in the Mediterranean and Central Europe and O_3 concentrations exceeded 40 ppb on 37.3 % of forest sites. Epidemiological studies, where biological responses are compared with field data, may provide useful information for establishing the best standards and thresholds for forest protection and deriving new stomatal flux based critical levels. Validation of thresholds under different field conditions is still missing. Further studies under Mediterranean field conditions that combine ozone monitoring with forest-health indicators for a deeper understanding of its impact on typical forests along the Adriatic coast (*Pinus nigra* and *Quercus pubescens*) is needed. Therefore, *in situ* investigation of forest-health response indicators together with comprehensive datasets of newly installed active O_3 monitors with solar panels stations, calculation of ozone-exposure and flux-based standards and estimation of maximum levels of ozone that the forest ecosystem can tolerate, will raise awareness to public about O_3 pollution and impacts.

Experimental Monitoring of Mediterranean Forest Ecosystems on the Eastern Adriatic Coast

Lukrecija Butorac[1*], Tamara Jakovljević[2], Ivan Seletković[2], Nenad Potočić[2], Jasnica Medak[2], Ivan Limić[1], Alessandra De Marco[3] and Yasutomo Hoshika[4]

[1]*Institute for Adriatic Crops and Karst Reclamation, Split, Croatia*

[2]*Croatian Forest Research Institute, Jastrebarsko, Croatia*

[3]*ENEA Casaccia Research, Rome, Italy*

[4]*National Research Council -Research Institute on Terrestrial Ecosystems, Sesto Fiorentino, Italy*

Abstract

Mediterranean forest ecosystems are increasingly threatened by the combined effects of climate change and air pollution, with tropospheric ozone representing one of the major environmental stressors affecting forest vitality. To improve understanding of ozone impacts under natural Mediterranean conditions, an integrated experimental monitoring system has been established within a *Pinus nigra*, and *Quercus pubescens* stands on the eastern Adriatic coast. The monitoring sites have been equipped with an automatic station for continuous measurements of ozone concentration and meteorological variables, including air temperature, relative humidity, precipitation, solar radiation, wind speed and direction, atmospheric pressure, soil temperature, and soil moisture. High-resolution environmental data will enable the calculation of ozone exposure metrics and stomatal ozone flux. Forest health is being evaluated using complementary structural, physiological, and ecological indicators. Annual monitoring includes crown defoliation and discoloration, radial and height growth, visible ozone foliar injury, vegetation diversity, and soil and foliar nutrient status. Tree growth is monitored using dendrometer bands, while laboratory analyses determine macro and micronutrient concentrations in soil and needles according to standardized protocols. The integration of continuous environmental monitoring with repeated field observations will provide a robust dataset for analyzing interactions

between ozone pollution, climatic conditions, and forest responses. The results are expected to improve ozone risk assessment, identify sensitive biological indicators, and support the development of long-term monitoring strategies for Mediterranean forest ecosystems.

Contrasting Effects of Biochar and Liming on Metal and Metalloid Availability in Extremely Acidic and Saline Soils

Ana Obrador[1,2*], Demetrio González[1,2], Juan Alonso[3], Carolina Mancho[3], María Carmen Lobo[3], Patricia Almendros[1,2] and Mar Gil-Diaz[3]

[1]Department of Chemistry and Food Technology, School of Agricultural, Food and Biosystems Engineering, Technical University of Madrid, Madrid, Spain

[2]Center for Studies and Research on the Management of Agricultural and Environmental Risks, Polytechnic University of Madrid, Madrid, Spain

[3]Department of Agroenvironmental Research, Madrid Institute for Rural, Agricultural and Food Research and Development, Madrid, Spain

Abstract

Metal(loid) is, quantitatively, among the main contaminants in soils. Due to their nonbiodegradable nature, they can accumulate, posing significant risks to human health and ecosystems. In this context, increasing attention has been paid to *in situ* immobilization techniques aimed at reducing their bioavailability, thereby limiting their uptake by organisms and preventing their transfer to other environmental compartments. The aim of this study was to evaluate the feasibility of using different immobilizing agents to remediate two extremely acidic and saline mining-industrial soils (I and II), multi-contaminated with metal(loid)s from the Odiel marshland area. A 30-day microcosm experiment was conducted using the treatments calcium carbonate (16 $t \cdot ha^{-1}$), biochar (150 $t \cdot ha^{-1}$), and a combination of both. Changes in soil pH, redox potential, and metal(loid) availability, using the toxicity characteristic leaching procedure test (USEPA Method 1311) were evaluated. All treatments increased soil pH, more markedly in soil II, and reduced redox potential. In soil I, all treatments significantly reduced the bioavailable concentrations of arsenic, chromium, copper, and zinc. However, for cobalt and nickel, only the combined application was effective. In soil II, all treatments significantly reduced the bioavailability of copper, zinc, cobalt, and nickel, whereas that of arsenic and antimony increased, especially with the biochar treatments. Thus, biochar and alkaline amendments can effectively immobilize cationic metals. However, they may also increase the mobility of oxyanion-forming elements such as arsenic and antimony due to pH-induced changes in surface charge and sorption mechanisms, which are strongly dependent on soil properties.

Sewer Pollution Separator for Stormwater

Piotr Koszelnik*, Małgorzata Kida, Kamil Pochwat, Daniel Słyś and Sabina Ziembowicz

Rzeszów University of Technology, Poland

Abstract

Stormwater runoff from urbanized surfaces contains significant amounts of pollutants such as heavy metals, suspended solids, petroleum-derived compounds and microplastics, which, without prior separation, enter the sewer system or natural receivers directly. Studies show that the first 10 - 20 min of rainfall generate the so-called first flush, which is particularly rich in contaminants washed off impervious surfaces. Ineffective treatment of stormwater can overload sewer systems, leading to storm overflows and secondary environmental pollution. Mineral and organic suspended solids contribute to sedimentation and reduced hydraulic efficiency of sewer channels; therefore, their early separation is essential. Petroleum-derived substances and fats form persistent surface films that impede oxygen transfer and hinder subsequent treatment processes. Microplastics have been detected in the majority of stormwater streams, confirming the need for separators capable of removing them at the preliminary stage. The described invention is a three-stage stormwater pollution separator designed for sewer systems. It consists of a preliminary, intermediate, and final tank, each contributing to sequential removal of mineral compounds, fats, suspended solids, petroleum-derived substances, and microplastics. The intermediate tank contains a perforated plate that disperses the liquid stream and enhances microplastic removal, while an applicator doses oily substances to support the separation process. Solenoid valves controlled by an automated unit regulate flow within the system. The design provides an efficient, low-invasive solution for advanced stormwater treatment, addressing the needs of water network operators, environmental experts, and the construction sector.

Circular Cities and Regions Initiative Knowledge Hub: Scaling up Circular Economy Transitions in European Cities and Regions - Achievements, Lessons Learned, and Policy Recommendations

Noemi García-Lepetit[1*], Mireia Ferri[1], Alba Matamoros[1], Lizeth Lopez[2], Alice Fantin[2], Carlos Serra Castells[3] and Noelia Fernández Salido[3]

[1]*Kveloce (Senior Europa S.L.), Valencia, Spain*

[2]*European Association for Local Democracy, France*

[3]*University of Valencia, Valencia, Spain*

Abstract

The circular cities and regions initiative knowledge hub (Horizon Europe, grant no. 101135174, 2024 - 2026) was designed to amplify the impact of the European Union's circular cities and regions initiative by expanding stakeholder networks, systematizing actionable knowledge, and accelerating circular economy adoption. As the project concludes, this paper presents its main achievements, key lessons, and preliminary policy recommendations. The project delivered results across four dimensions: public engagement, innovation and technology, business models and financial support, and impact evaluation. Drawing on a multidisciplinary consortium of 11 partners from 6 European Union countries, the Hub operationalized three core principles: easy access to structured knowledge, tailored mentoring, and effective awareness-raising. Key outputs included a systematized knowledge repository, a mentoring scheme for over 25 early-stage circular economy cities, and targeted capacity-building activities for regional authorities. Key lessons highlight that co-designed, contextualized support — combining group workshops with individual mentoring — outperforms generic knowledge transfer. Adaptive management proved essential when geopolitical or institutional barriers constrained implementation. Preliminary policy recommendations emerging from the project point to the need for stronger institutional frameworks enabling circular economy transitions at city and regional level, improved access to finance for circular initiatives, and more effective cross-sector and cross-border collaboration mechanisms — findings that will be further developed in the project's forthcoming policy recommendations deliverable.

Digital Information System for Polish Maritime Areas CSI-POM and CSI-POM 2

Lidia Dzierzbicka-Głowacka[*], Dawid Dybowski, Maciej Janecki and Artur Nowicki

Institute of Oceanology of the Polish Academy of Sciences, Sopot, Poland

Abstract

The goal of the project "Digital Information System for Polish Maritime Areas" is to monitor and forecast the state of the southern Baltic environment and its changing physical conditions as well as chemical and biological conditions, thereby providing a modern tool CSI-POM/web applications for effective environmental management in the polish maritime economy. The outcome of combining knowledge with an integrated package of tools, including mathematical methods (numerical modeling), will be forecasts of hydrodynamic and biochemical parameters, and physicochemical and biological processes, defining the highly stratified spatiotemporal structure of polish maritime areas. The developed model will enable the tracking of biochemical parameters and processes, significantly facilitating; I) the forecasting of threats (through the influx of nutrient-rich freshwater from rivers, causing cyanobacterial blooms in the coastal zone) and economic activities (such as the impact of agriculture on marine waters, fisheries, or mariculture), II) the work of rescue services, such as the maritime search and rescue service (searching for and rescuing any person in danger at sea, searching for a missing object at sea, and combating chemical and oil pollution of the marine environment) in polish maritime areas, and III) the work of units for environmental impact assessment based on real premises and detailed information about the state of the environment at the project site.

A Spatial Planning Framework for Net-zero Carbon Transition and Urban Climate Adaptation in Duzce, Turkiye

Nermin Başaran[*], Selim Pişkin, Aleyna Kolbaş, and Ece Pehlivan

Duzce University, Duzce, Turkiye

Abstract

Rapid urbanization in Duzce, Turkiye, has intensified climate-related pressures, including urban heat accumulation, ecological fragmentation, and declining carbon-regulation capacity. As medium-sized cities seek pathways toward carbon neutrality

and climate resilience, spatial planning must integrate ecosystem-based solutions that enhance both carbon sequestration and urban adaptation. This study develops a geographic information system-based planning framework linking urban land-cover structure, urban morphology, ecological connectivity, and carbon-related ecosystem services to support nature-based climate action in Düzce. The methodology combines land-cover classification, ecological network analysis, climate-sensitive spatial assessment, and ecosystem service mapping of carbon storage and sequestration capacities. Urban land-cover analysis reveals a fragmented green infrastructure structure. High-density urban fabric occupies 8.7% of the urban area, while low-density urban fabric accounts for 71.1%. Forest ecosystems represent only 0.7% of the urban core, indicating limited ecological continuity despite dispersed green spaces. Carbon-regulation assessment shows substantial differences among land-cover classes. Forest ecosystems have the highest sequestration capacity, reaching approximately 3700 kg/ha/yr, followed by urban green areas at 2943 kg/ha/yr. Continuous urban fabric shows the weakest carbon-regulation performance and the smallest carbon storage capacity. Forested areas also contain the highest above-ground biomass and soil carbon stocks, confirming their strategic role in urban carbon management and climate adaptation. The findings indicate that Duzce's climate resilience is constrained less by green-space quantity than by spatial fragmentation and weak ecological connectivity. Carbon-neutral spatial planning should therefore prioritize forest conservation, ecological corridor development, neighborhood-scale greening, and the transformation of isolated green patches into an integrated urban green infrastructure network.

Bridging Digital and Stakeholder Networks: Socio-ecological Modeling for Invasive and Native Fisheries Management

Veronica Malabanan Lucchese*

University of Maryland Center for Environmental Science, USA

Abstract

Introduced in the 1970s, invasive blue catfish have rapidly expanded across Chesapeake Bay due to their adaptability and appetite, impacting native striped bass and blue crab fisheries. An integrated analysis of trophic and human dimensions is necessary to inform adaptive management. This study employs socio-ecological network analysis to examine fisheries management networks in the Patapsco, York, and Rappahannock River watersheds. Integrating ecological and stakeholder networks into a multi-level model, this research explores cross-scale interdependencies among invasive and native fishery networks. Building on prior Bay socio-ecological networks of invasive blue catfish and native fisheries, this study expands by incorporating survey data to explore how real-world stakeholder interactions compare to online fisheries governance. Over 400 Chesapeake Bay fisheries stakeholders were surveyed to assess perceptions and networks related to blue catfish, striped bass, and blue crab. Stakeholder and species interaction data were organized by watershed and stakeholder type to reveal nuanced differences in knowledge relationships across communities and species. These survey data enabled socio-ecological network analysis that identified highly connected, bridging, and excluded actors. Survey-based networks were directly compared to previously constructed web-scraped networks to evaluate how digital representations of management connections align with observed stakeholder relationships. To ensure accessibility, findings were communicated back to local communities through an ethnographic film that shares stakeholder perspectives across the region. This integrative approach advances understanding of human-ecological interactions in the Chesapeake Bay and demonstrates how multi-level network modeling can enhance adaptive governance.

Rising Hot Nights, Persistent Cold Days, and an Aging Population: Thermal Extremes and Cardiovascular Hospital Burden in Hong Kong, 2013 - 2023

Shen Ruililin*

The University of Hong Kong, China

Abstract

Climate change is reshaping thermal exposure in subtropical cities, with direct implications for human cardiovascular health. Hong Kong is dense, humid, and rapidly aging; both heat and cold can stress thermoregulation and precipitate acute cardiac and cerebrovascular events. Official Hong Kong observatory extremes-hot nights (daily minimum ≥28 ˚C), very hot days (daily maximum ≥33 ˚C), and cold days (daily minimum ≤12 ˚C)-provide an operationally relevant exposure framework for hospital preparedness. This poster presents validated 2013 - 2023 patterns of thermal extremes alongside population aging, establishing the climate–human exposure base for a planned ecological assessment of cardiovascular hospital admissions. Daily Headquarters observations were aggregated to 132 calendar months and cross-checked against official year's weather summaries (33/33 match). Mid-year Census and Statistics Department age–sex estimates provided denominators, with particular attention to ages 65 - 69 and 70 - 74. A monthly time-series of hospital authority admissions for acute myocardial infarction and stroke is predefined and awaits secure data access. Annual hot nights rose from 10 in 2013 to 61 in 2021 and 56 in 2023; very hot

days increased similarly. Cold days did not disappear (13 - 14 days in recent years). Populations aged 65 - 69 and 70 - 74 nearly doubled (+93% and +99%). Warming is already intensifying overnight and daytime heat while cold risk persists, coinciding with rapid growth of clinically vulnerable older cohorts. These human-facing climate shifts underscore the urgency of quantifying contemporary thermal–cardiovascular hospital burden for adaptation planning.

Arctic in Climate Change: Geochemical Assessment of Arctic Postglacial Deposits Under Warming

Yana Tkachenko*, Juliana Souza-Kasprzyk and Przemystaw Niedzielski

Adam Mickiewicz University, Poznan, Poland

Abstract

Climate warming is not uniform across the globe: the Arctic is warming much faster than the global average, a phenomenon known as Arctic amplification. A key driver is the decrease in albedo: the reduction in ice cover leads to greater absorption of solar energy, which in turn further accelerates glacial melting. As glaciers retreat, pollutants such as heavy metals and persistent organic pollutants, transported over long distances through the atmosphere and accumulated in glacial ice, which acts as a "cold trap", are released. As a consequence, these contaminants can be released into the environment. Their subsequent fate depends on transport, transformation, sorption, and desorption processes, as well as biological interactions and environmental factors, which are governed by the pollutants' properties and the ecological context. Understanding these processes is particularly important in polar regions such as Svalbard, where unique environmental conditions influence the fate of contaminants. This study assessed the mineralogical and geochemical variability of postglacial deposits from Petunia Bay, Svalbard, using non-destructive analytical methods, such as attenuated total reflectance fourier transform infrared spectroscopy and portable X-ray fluorescence spectroscopy. We further examined possible relationships between mineral composition and metals under arctic climate conditions. The deposits contained a similar set of mineral groups (e.g., carbonates, silicates, etc.), whereas metal concentrations differed significantly among the sampling sites. These differences may reflect the selective adsorption of metals by specific mineral assemblages; for example, dolomite has a high affinity for cadmium.

Machine Learning Assessment of the Combined Influence of Winter Conditions and Cigarette Smoke on Air Pollution (P.M2.5 and P.M10)

Sitara Anjum[1*] and Sharoon Anjum[2]

[1]*University of the Punjab, Lahore, Pakistan*

[2]*Department of Mathematics, Forman Christian College University, Lahore, Pakistan*

Abstract

This study examined the effects of winter conditions and cigarette smoking on the concentrations of particulate matter such as PM2.5 and PM10 using machine learning. Air pollution arises from various human activities and natural events; however, human activities are increasing pollution levels both indoors and outdoors. Cigarette smoking is a significant contributor in the indoor air pollution because burning tobacco emits toxic gases such as fine particulate matter. Toxic gases emitted from cigarette smoke degrade the quality of the surrounding air. Therefore, cigarette smoking not only affects the smoker but also has harmful effects on non-smokers. This can lead to several health risk such as damage lungs, increase the risk of respiratory or cardiovascular disease and asthma. Air pollution is a major issue in developing countries. This study was conducted in Lahore, Pakistan. Air quality analysis was observed using temperature, relative humidity, and carbon dioxide. The research was carried out during the winter season, in the period from October to January. Furthermore, cigarette smoking increases the concentration of particles because pollutants stay longer periods due to low temperature. Research findings revealed an increase in particulate matter (P.M2.5 and P.M10) concentration during the winter season. The survey has reveals that individuals aged 45 - 50 are the most affected by indoor air pollution. Participants reported respiratory problem due to combined effects of toxic pollutants. Python based machine learning has revealed the combined effects of winter conditions and cigarette smoke. This study provides public awareness and prompting policymakers and government to take proactive measures to control air pollution.

Digital Twins for Green Hydrogen Production: From Technology-resolved Comparison to Magneto-tomography Coupling

Hamza Er-rebyiy*, Badr Errabyiy, Adiba El Bouzekri El Idrissi and Amine Alaoui Belghiti

Laboratory of Engineering Sciences for Energy, National School of Applied Sciences of El Jadida, Chouaib Doukkali University, El Jadida, Morocco

Abstract

Water electrolysis powered by renewable electricity is the most scalable route to green hydrogen, yet industrial deployment remains limited by accelerated component degradation, poor response to fluctuating renewable input, and the inability to observe the internal state of an operating cell. Digital twins are widely proposed to address these challenges, but existing reviews rarely compare implementations across the four electrolysis pathways — alkaline, anion exchange membrane, proton exchange membrane, and solid oxide-or examine their common structural limitation. Using a PRISMA-based Scopus search (2021 - 2026) with eligibility screening, we show that proton exchange membrane twins are the most mature, combining multi-physics simulation with physics-informed neural networks (R^2 = 0.95), while alkaline remains largely electrical, anion exchange membrane relies on offline data-driven surrogates, and no validated integrated twin yet exists for anion exchange membrane or solid oxide. Critically, every implementation reviewed is fed by the same narrow terminal measurements (voltage, current, bulk temperature, and flow rate), leaving the internal state structurally underdetermined, a condition we term observational poverty. We propose coupling digital twins with magneto-tomography, which reconstructs internal current distribution non-invasively from boundary magnetic-field measurements (Hall-effect sensor arrays with a Biot–Savart inverse model, about 5% field agreement), through a hybrid architecture combining reduced electrochemical models with an online self-calibrating machine-learning layer. Bibliometric searches on Web of Science and Scopus confirm this coupling has not yet been reported, revealing an open, experimentally tractable research direction relevant to fault localization, severity quantification, and remaining-useful-life prediction, with solid oxide requiring high-temperature sensing above 500 °C.

From Olive Waste to Clean Water: Circular Valorization of Olive Stone into Biochar for Continuous Heavy-metal Removal

Kawtar Ezzahi[1*], Imad Rabichi[1], Loubna El Fels[1], Rachid Idouhli[2] and Nabil Rochdi[3,4]

[1]Laboratory of Water Sciences, Microbial Biotechnologies, and Natural Resources Sustainability, Unit of Microbial Biotechnologies, Agrosciences, and Environment, CNRST Labeled Research Unit N°4, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakesh, Morocco

[2]Laboratory of Physical-Chemistry of Materials and Environment, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakesh, Morocco

[3]Laboratory of Innovative Materials, Energy and Sustainable Development, Cadi Ayyad University, Marrakesh, Morocco

[4]Department of Physics, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakesh, Morocco

Abstract

Olive stone waste, an abundant agro-industrial byproduct, was valorized into biochar through pyrolysis and evaluated as a sustainable adsorbent for the continuous removal of toxic heavy metals from contaminated water. The influence of pyrolysis conditions on biochar properties and adsorption performance was systematically investigated. The produced biochar was characterized using scanning electron microscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction, Fourier transform infrared spectroscopy, Brunauer Emmett Teller analysis, and electrical and a well-developed porous structure favorable for adsorption. Its performance was assessed in a continuous fixed-bed column system for the removal of hexavalent chromium, divalent lead, and divalent cadmium. Complete cumulative removal of all metals was observed during the initial fil. Divalent lead showed the fastest adsorption kinetics. Breakthrough curves were successfully described using the Thomas, Adams Bohart, and Yoon Nelson models, revealing markedly different column behaviors with breakthrough times ranging from 35 min for divalent lead to 2105 min for divalent cadmium. Mechanistic investigations indicated that redox reactions, ion exchange, electrostatic attraction, and surface complexation governed metal removal. This study demonstrates, for the first time, the simultaneous continuous removal of hexavalent chromium, divalent lead, and divalent cadmium using unmodified olive stone waste-derived biochar under realistic fixed-bed conditions, highlighting its strong potential as a low-cost and scalable solution for sustainable wastewater remediation.

Techno-environmental Analysis of a Solar-thermal Organic Rankine Cycle-based Hybrid Microgrid Using Nine Organic Working Fluids for a Community in Gonyeli, North Cyprus

Dumebi Martina Nwajei* and Keyvan Bahlouli

Cyprus International University, Nicosia, Cyprus

Abstract

Small communities that rely on diesel generators face high fuel costs and large carbon dioxide (CO_2) emissions. Hybrid renewable energy systems that combine renewable sources, such as photovoltaic panels and wind turbines, with diesel generators and battery energy storage can reduce this dependence. However, renewable energy resources are intermittent. These microgrids are usually optimized for cost, while the environmental benefit of adding a solar-thermal organic Rankine cycle (ORC) is less often quantified. This study presents a techno-environmental analysis of a photovoltaic/ORC/diesel generators/battery energy storage hybrid renewable energy system for a small community in Gonyeli, North Cyprus. Nine organic working fluids were evaluated, and the least-cost configuration was found using HOMER Pro. The renewable fraction, fuel use, and CO_2 emissions were then compared with a photovoltaic/diesel generators/battery energy storage baseline which had a renewable fraction of 35.8% and emitted 96,070 kg of CO_2 per year. Adding the ORC reduced CO_2 emissions by 19.4 - 39.8% and raised the renewable fraction by 12.7 - 25.6%, while the net present cost increased by 3.3 - 13.7%. Nonane gave the best environmental result: with a 4.2% increase in cost, the annual CO_2 emissions fell to 57,880 kg per year, diesel use reduced by 39.8%, and the renewable fraction reached 61.4%. Toluene, heptane, and benzene reduced CO_2 emissions by 36.4 - 38.5%, and heptane was the least-cost ORC option (+3.3%). The results show that integrating a solar-thermal ORC with a suitable working fluid can substantially reduce the fuel use and carbon footprint of diesel-dependent microgrids.

Hybrid Stabilization of Clayey Soil Using Bio-enzyme (TerraZyme) and Date Palm Fiber

Uneb Gazder[1,2*], Madiha Abid[3], Syeda Madiha Zaidi[3] and Md Kamrul Islam[4]

[1]*Department of Civil Engineering, School of Engineering, Monash University Malaysia, Malaysia*

[2]*Monash Climate-Resilient Infrastructure Research Hub, School of Engineering, Monash University Malaysia, Malaysia*

[3]*Department of Urban & Infrastructure Engineering, NED University of Engineering & Technology, Pakistan*

[4]*Department of Civil and Environmental Engineering, College of Engineering, King Faisal University, Saudi Arabia*

Abstract

Expansive clayey soils are a major challenge to highway construction. Conventional stabilizers such as cement and lime have major environmental and economic disadvantages, such as high carbon emissions and material costs. This study was motivated by the need to develop a sustainable, locally available and cost-effective alternative for improving problematic clayey soils in this region. This research investigated the use of a bio-enzymatic stabilizer, TerraZyme, produced from fermentation and sodium hydroxide treated date palm sheath fiber from agricultural waste, as a hybrid stabilization system for locally collected clayey soil. Nine mix designs were prepared: control, two TerraZyme-only mixes, two fiber-only mixes and four hybrid combinations. Each mix was tested under controlled laboratory conditions following American Society for Testing and Materials standards for Atterberg limits, standard proctor compaction, unconfined compressive strength, California bearing ratio, swelling, and shrinkage. The interaction effects between the two additives were modeled and analyzed using response surface methodology. TerraZyme was the most effective in reducing the plasticity. At optimum dosage of enzymes, the liquid limit and plastic limit decreased by 31 and 38% respectively. The results indicated that the hybrid combination of 1% fiber and 5% TerraZyme achieved the maximum 28-day compressive strength and bearing capacity with 54% and 39% improvement over the untreated soil, respectively. The best treatment for swelling control was a combination of 0.5% fiber and 3% TerraZyme, which reduced the swelling by 26%. The research revealed the hybrid use of TerraZyme and date-palm sheath fiber as a technically feasible and environmentally sustainable solution for expansive clayey soil stabilization.

Two Forms of Taxation, Majority Voting, and Water Pollution Cleanup in Cities Along the Ganges

Amit Batabyal[1*] and Hamid Beladi[2*]

[1]*Rochester Institute of Technology, USA*

[2]*University of Texas, San Antonio, USA*

Abstract

Water pollution in the Ganges river in India is particularly serious along several northern cities such as Kanpur, Prayagraj, and Varanasi. On the assumption that pollution cleaning decisions are decentralized in individual cities, we analyze the implications of two kinds of taxation and majority voting in a city, for pollution cleanup. First, we examine how a poll tax on citizens of the city under study and majority voting together affect total pollution cleanup. Second, we study how a proportional tax on the citizens of the same city and majority voting together impact aggregate pollution cleanup. Finally, for alternate income distributions, we discuss which of the two preceding cleanup amounts is closer to the efficient amount of cleanup.

Environmental Implications of Polycyclic Aromatic Hydrocarbon Accumulation in Coastal Chiba River Sediments, North-East Tunisia: Sources, Geographic Information System-based Spatial Distribution, Long-term Trends, and Toxicity Assessments

Mariem Trifi[1*], Anis Gasmi[2], Abdelkrim Charef[1] and Cristina Carbone[3]

[1]*Georesources Laboratory, Water Research and Technology Center, Borj-Cedria Technopole, Soliman, Tunisia*

[2]*Geomatics of Geosystems Laboratory, University of Manouba, Manouba, Tunisia*

[3]*Department of Earth, Environment and Life Sciences, University of Genoa, Genova, Italy*

Abstract

Polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants. Several PAHs, including benzo[a]pyrene, have been identified as carcinogenic to humans, and these compounds are prevalent in environmental media, including air, water, and soil, posing a significant risk to human health. In many regions of the world, PAH concentrations remain high despite improved legislation and monitoring. It is therefore vital to characterize their profiles, define their spatial distribution, identify their potential sources, and evaluate their long-term evolution. In the current study, eight sediment cores and sixteen surface sediments were collected from the Chiba River (Northeastern Tunisia) and analyzed to determine the concentration levels, spatial distribution, possible sources, and toxic equivalent (TEQ) levels of thirteen PAHs. The findings revealed strong horizontal and vertical gradients in PAH concentrations, with the highest levels associated with the fine fractions and organic-rich sediments near the wastewater treatment plant and the lowest concentrations observed in the riverbed. The combined application of molecular diagnostic ratios (the low-to-high molecular weight ratio, Anth/(Anth+Phe), and BaA/(BaA+Chry)) and principal component analysis predominantly indicated that PAHs originated from mixed petrogenic and pyrogenic sources. Petrogenic inputs were associated with wastewater treatment plant effluents, petroleum residues, and fuel leaks, while pyrogenic contributions were from vehicular emissions, fossil fuel combustion, biomass burning, and other high-temperature processes occurring within the surrounding watershed. Batch desorption tests showed a significant decrease in PAH release with depth, indicating increased sequestration and reduced bioavailability. Moreover, a geographic information system-based spatial interpolation method, inverse distance weighting, was used to map the spatial distribution of PAH hotspots. These results supported the idea that the Chiba River acted as a major sink and stabilizer of PAHs, limiting their downstream remobilization to the adjacent lagoon and coastal marine environments. TEQ-BaA levels across the sampled locations indicated that benzo[a]pyrene was the most significant contributor to the overall TEQ concentrations. Finally, this integrated approach provides new insights into PAH dynamics and source apportionment in the Chiba river system, subjected to multiple anthropogenic pressures.

Valorization of Thermal Treatment Slag for the Treatment of Industrial Wastewater

Abel Menéndez, Laura Megido[*], Yolanda Fernández-Nava and Jesús Rodríguez-Iglesias

University of Oviedo, Spain

Abstract

Thermal treatment slags are generated in waste-to-energy facilities and represent a significant secondary material stream with growing interest in valorization within circular economy frameworks. In parallel, coke wastewater is a complex and problematic

industrial effluent due to its large volume and highly toxic pollutant load, including both organic and inorganic compounds. Its treatment is particularly challenging, as these contaminants can interfere with conventional treatment processes, often requiring prior or advanced treatment stages. This study assesses the use of incineration slag as an adsorbent for the treatment of real coke wastewater. The raw material (1 - 2 mm in size) was subjected to controlled thermal and/or chemical activation processes to study its surface reactivity and adsorption capacity. Adsorption tests were carried out under realistic conditions. The treated coke wastewater showed a reduction in some key pollution indicators: around 46% in chemical oxygen demand and 93% in nitrates. These preliminary results suggest that this material could be a valuable secondary resource and a promising adsorbent for industrial wastewater treatment. Further optimization of particle size, activation conditions, and contact time is expected to enhance removal efficiencies.

Loratadine Hypochlorination: Ecotoxicological Evaluation of Disinfection Byproducts

Chiara Russo[1*], Armando Zarrelli[2], Elena Orlo[1], Roberta Nugnes[1], Davide Pio Oliviero[2], Giovanni Di Fabio[2], Giovanni Luongo[3], Marina Isidori[1] and Margherita Lavorgna[1]

[1]Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania Luigi Vanvitelli, Caserta, Italy

[2]Department of Chemical Sciences, University of Naples Federico II, Naples, Italy

[3]Italian Association for the Promotion of Research on Environment and Human Health, Dugenta, Italy

Abstract

Loratadine (LORA), a widely used second-generation antihistaminic drug, is frequently detected in aquatic environments (ng - µg/L) due to its incomplete removal during wastewater treatment. Upon chlorination, LORA can undergo chemical transformation, generating disinfection byproducts (DBPs) with physicochemical and toxicological properties distinct from those of the parent compound. This study evaluates the ecotoxicological relevance of LORA transformation under neutral hypochlorination conditions representative of conventional wastewater treatment. Eight DBPs were formed during the reaction and subsequently isolated by high-performance liquid chromatography and structurally characterized by nuclear magnetic resonance and mass spectrometry. Of these, five compounds have been reported here for the first time. Ecotoxicological effects were assessed in freshwater species representing different trophic levels: the microalga *Raphidocelis subcapitata* as producer and the rotifer *Brachionus calyciflorus* as primary consumer. Algal growth inhibition occurred at mg/L concentrations, well above environmentally relevant levels. In contrast, rotifers exhibited higher sensitivity: acute median mortality was observed at concentrations in the hundreds of µg/L ranges, whereas chronic reproductive impairment occurred at concentrations ranging from a few to several hundred ng/L, overlapping with environmentally relevant exposure levels. The parent compound induced only a 38% effect at 2000 ng/L under chronic conditions, indicating lower toxicity compared to the DBPs. Collectively, these findings demonstrate that hypochlorination enhances the chronic ecotoxicological hazard of LORA by generating transformation products that exhibit grater biological activity and pose a higher environmental risk than the parent compound.

Seasonal Assessment of Water Quality and Heavy Metal Contamination in Bandra Talao, Mumbai, and Its Phytoremediation Using Aquatic Macrophytes

Zohra Ulfat Shaikh[*] and Yogita Shinde

Department of Chemistry, KC College Churchgate, HSNC University, Mumbai, India

Abstract

Bandra Talao is a 200-year-old, 7.5-acre heritage lake located in Bandra, Mumbai, that has been significantly impacted by organic and inorganic pollution arising from sewage see page and surface runoff. This study evaluates the seasonal variation in physicochemical water quality and heavy metal contamination of the lake over five seasons from November 2024 to July 2025,along with the effectiveness of aquatic macrophytes for phytoremediation. Five macrophyte species-water hyacinth (*Eichhornia crassipes*), European water clover (*Marsilea quadrifolia*), giant salvinia (*Salvinia molesta*), water mimosa (*Neptunia oleracea*), and lemon bacopa (*Bacopa caroliniana*) - were employed for a 30-day phytoremediation treatment. Twenty-three physicochemical parameters and five heavy metals, namely lead, nickel, copper, cadmium, and mercury, were analyzed before and after treatment during each season. The results indicated that pollution levels were particularly pronounced during the summer and monsoon periods, with turbidity, total dissolved solids, and chemical oxygen demand reaching their highest levels in May and July. A single 30-day phytoremediation cycle resulted in substantial reductions in key pollutants, including 33 - 45% reduction in biochemical oxygen demand, 33 - 56% reduction in chemical oxygen demand, upto 25% reduction in total dissolved solids, and up to 98% removal of lead. Among the tested macrophytes, European water clover and water hyacinth demonstrated

the most consistent overall pollutant-removal performance. Although phytoremediation substantially improved several water-quality parameters, some values remained above the permissible limits recommended by World Health Organization and Bureau of Indian Standards after a single treatment cycle. The findings therefore suggest that macrophyte-based phytoremediation can serve as a cost-effective and environmentally sustainable pre-treatment or polishing approach but should be integrated with appropriate engineered measures for comprehensive restoration and long-term management of Bandra Talao.

Amphibian Responses to Temporary Construction Disturbance in a South Korean Urban Wetland: A Six-year Monitoring Study

Yundoo Lee* and Jiin Suh

Supyeoul Climate and Environment Network, Republic of Korea

Abstract

Anthropogenic disturbances threaten wetland amphibian populations through habitat fragmentation, degradation, and loss. This study analyzed six years (2020 - 2026) of citizen science visual surveys from an urban wetland in Seoul, South Korea, to evaluate amphibian responses to a one-year construction disturbance. We examined amphibian abundance, species richness, and community composition across three study phases: before (2020 - 2021), during (2022), and after (2024 - 2026) construction. Generalized linear models were used to analyze species abundance and richness, while PERMANOVA was used for community composition. The findings showed that total adult abundance and species richness did not differ significantly among the three study phases. Species-specific abundance showed contrasting responses among the three focal species: Boreal digging frog (*Kaloula borealis*) remained relatively stable, Japanese tree frog (*Dryophytes japonicus*) abundance increased significantly from before to after construction, and black-spotted pond frog (*Pelophylax nigromaculatus*) declined significantly from during too after construction. Community composition shifted modestly across phases, with significant differences only between the during- and after-construction phases. Together, these findings suggested that the temporary construction disturbance had a relatively limited effect on community-level amphibian responses, although species-specific responses varied based on species' ecological characteristics. Urban wetland management should therefore incorporate multiple ecological indicators and develop species-specific management strategies. Long-term ecological monitoring, including citizen science surveys, may provide an evidence-based framework for urban wetland management. Since continuous local conservation actions–including water level maintenance, habitat quality management, and responsible urbanization advocacy–occurred throughout the study period, future comparative studies should determine whether long-term conservation actions influence amphibian responses to temporary construction disturbance.

Against the Odds: Microplastic Persistence in the Dynamic Ecosystem of Shallow Hydrothermal Vents

Mark June S. Consigna[1*], Yi-Ta Shao[1] and Jiang-Shiou Hwang[1,2]

[1]*Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan*

[2]*Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung, Taiwan*

Abstract

Shallow-water hydrothermal vents represent extreme marine habitats, yet the extent to which anthropogenic microplastics infiltrate these specialized benthic communities remains poorly understood. Here, we evaluate the tissue-level distribution, structural morphology, and chemical profiles of internal microplastics in the vent crab *Xenograpsus testudinatus* (N = 85) to decipher uptake mechanisms within extreme environments. Utilizing transmission fourier-transform infrared spectroscopy alongside scanning electron microscopy with energy-dispersive X-ray spectroscopy, microplastics were identified in 76.47% of analyzed specimens. Burden concentrations peaked within digestive tract tissues predominantly the midgut (45.56%) followed by the hepatopancreas before reaching respiratory organs. Principal component analysis and Pearson correlation metrics revealed distinct uptake vectors: fibrous and red synthetic particles tightly clustered around dietary ingestion routes in digestive organs, whereas rigid fragments isolated independently as a function of passive physical entanglement in the gills. Synthetic signatures were primarily composed of polyurethane and polyethylene terephthalate, pointing toward terrestrial runoff and regional fishing operations as primary input vectors. These distinct partitioning pathways demonstrate high direct transfer efficiency in benthic detritivores, highlighting *X. testudinatus* as a compelling bioindicator candidate for monitoring marine debris at the base of extreme ecosystems. Ultimately, while this species exhibits remarkable adaptation to harsh hydrothermal chemistry, chronic internal accumulation of synthetic polymers introduces a novel physical stressor that warrants further investigation into long-term physiological and trophic consequences.

Tracking Antibiotic Resistance Genes, Mobile Genetic Elements and Antibiotics Across Wastewater and Sludge Treatment in a Southern Spain Wastewater Treatment Plant

Jaime Villaverde[1*], Alba Lara-Moreno[1], Fernando Madrid[1] and Marina Rubio-Bellido[2]

[1]*Institute of Natural Resources and Agrobiology of Seville, Department of Agrochemistry, Environmental Microbiology and Soil Conservation, Spanish National Research Council, Seville, Spain*

[2]*Department of Microbiology and Parasitology, Faculty of Pharmacy, University of Seville, Seville, Spain*

Abstract

Wastewater treatment plants (WWTPs) are recognized hotspots for the emergence and dissemination of antimicrobial resistance (AMR). This study examines the abundance and persistence of antimicrobial resistance genes (ARGs), mobile genetic elements (MGEs), and antibiotic residues in influent and effluent wastewater, dehydrated sludge, and composted sludge from a municipal WWTP in southern Spain. Influent wastewater exhibited high loads of ARGs, particularly macrolide lincosamide streptogramin B, aminoglycoside, tetracycline, quinolone, and multidrug resistance genes, along with abundant MGEs such as intI1, IS26, and qepA. Although treatment substantially reduced these determinants, many remained detectable in the final effluent. Sludge matrices accumulated high concentrations of tetracycline and macrolide residues (e.g., doxycycline and azithromycin), exerting selective pressures that support ARG persistence. Composting markedly reduced overall ARG abundance but did not eliminate key MGEs, including integrons, insertion sequences, and transposons, which facilitate horizontal gene transfer during compost maturation. Several ARGs—such as aadA7, mphA, and mcr 1 - persisted or were enriched after composting, likely driven by co selection from residual antibiotics and heavy metals. Resistance indices indicated that wastewater samples align with European AMR benchmarks, whereas sludge associated values remain below global averages. The detection of clinically relevant genes—including mcr 1, qacEΔ1, merA, and carbapenemase-associated markers—highlights the potential for their transfer to pathogenic bacteria and incorporation into the environmental resistome. Overall, these findings underscore the role of WWTPs and sludge reuse practices as critical nodes in AMR propagation. They emphasize the need for integrated one health surveillance and advanced treatment strategies aimed at reducing gene mobility and long-term persistence in wastewater-derived matrices.

Machine Learning Prediction of Soil-to-plant Radionuclide Transfer Factors: A Literature-based Dataset

Milena P. Živković[1*], Predrag Kuzmanović[2], Abdulhady A. Abdullah[3] and Taha Y. Wais[4], Berivan F. Namq[5] and Ali H.D. Alshehri[6]

[1]*Faculty of Science, University of Kragujevac, Kragujevac, Republic of Serbia*

[2]*Department of Forensic Engineering, Faculty of Forensic Sciences and Engineering, University of Criminal Investigation and Police Studies, Belgrade, Serbia*

[3]*Artificial Intelligence and Innovation Centre, University of Kurdistan Hewler, Erbil, Iraq*

[4]*Department of Oncology, Medical Research and Care Centers, University of Mosul, Mosul, Iraq*

[5]*Department of Basic Science, College of Dentistry, University of Kirkuk, Kirkuk, Iraq*

[6]*Department of Radiological Sciences, College of Applied Medical Sciences, Najran University, Najran, Saudi Arabia*

Abstract

Soil-to-plant transfer factors are important parameters for evaluating radionuclide mobility in terrestrial ecosystems and estimating human exposure through the food chain. However, reported values often vary by several orders of magnitude because of differences in radionuclides, plant species, soil properties and experimental conditions. This study develops a literature-based dataset and a machine learning framework for predicting soil-to-plant radionuclide transfer factors. Data collected from published studies will be harmonized with respect to units, radionuclide notation and plant and soil categories, while duplicate records and evident inconsistencies will be screened. Because transfer-factor values are typically right-skewed, logarithmic transformation will be considered before model development. Predictors will include the radionuclide, plant category and available soil characteristics, such as soil type, pH and organic matter content. The predictive performance of random forest regression, K-nearest neighbors' regression, support vector regression and multiple linear regression will be systematically compared. Data splitting will be performed at the publication level to prevent observations from the same study from appearing in both training and test sets. Hyperparameters will be optimized using cross-validation, and performance will be evaluated using the coefficient of determination, root mean squared error and mean absolute error. If supported by validation results, the best-performing individual models will be combined into a weighted hybrid ensemble. Feature-importance and model-interpretation methods will be applied to identify the main factors governing radionuclide transfer. The proposed approach

may support the estimation of missing transfer factors and strengthen radioecological assessments when experimental data are limited.

The Role of the State in Promoting Sustainable Agriculture

Anita Boros*

Hungarian University of Agriculture and Life Sciences, Hungary

Abstract

Transitioning to sustainable agriculture is one of the most complex policy challenges globally, the success of which is closely linked to the capacity of the state institutional system, the coherence of the regulatory environment and the effectiveness of targeted public policy interventions. The challenges of climate change, soil degradation, decrease in biodiversity and food security mean that it is necessary for us to re-think the roles of the state in supporting the agricultural transition. The aim of this research is to conduct a comparative, multidimensional examination of the role of the state in the case of five key global agricultural actors – the European Union, the United States of America, China, Brazil, and India – revealing the strengths, limitations and elements that can be adapted more widely in each model. The central question of the research is what state regulatory, financing and institutional mechanisms prove to be the most effective in promoting the sustainable agricultural transition in different economic and governance environments. The theoretical novelty of the study is that it interprets state support for sustainable agricultural transition not as a mere regulatory issue, but along a complex governance and institutional capacity dimension, linking regulatory, incentive, innovation and knowledge transfer functions. The study was conducted using a systematic comparative policy analysis method, which is based on a structured content analysis of the relevant laws and normative regulations, national agricultural strategies, program evaluation reports and international databases (Food and Agriculture Organization, World Bank, and Organization for Economic Co-operation and Development) of the countries studied. In addition, the study also uses a comparative literature analysis to identify relevant elements of different models. The comparison is organized along five analytical dimensions: (a) the system of regulatory frameworks and mandatory requirements; (b) institutional solutions for quality assurance and official control; (c) incentives and support policy; (d) education and attitude formation; and (e) models of cooperation with civil, professional and scientific organizations. Research results show that there are significant differences between the five models examined. The European Union is characterized by a system of mandatory conditionality and eco-schemes, the United States of America by a combination of market-based and voluntary incentives, China by strong state directive-driven regulation, Brazil by a combination of forest protection legislation and producer registration systems, and India by the integration of agroecological state programs and local knowledge systems. The results of the research indicate that the common feature of successful models is the integrated use of state regulation, financial incentives and knowledge-based institutional support. The comparison highlights that the key factors for effective state involvement – regardless of the level of development and political system – are a stable and predictable regulatory environment, the integration of consistent support policy systems, long-term financing stability, close cooperation between actors in value chains, and support for the market entry of green innovations. The research also highlighted special attention to how these interventions contribute to climate adaptation, land degradation mitigation and agricultural sector emissions reduction. This research volunteers to contribute to the global policy discussion on sustainable agricultural transition and aims to develop a comparative policy transfer framework in order to assess the adaptability of individual government intervention models across national contexts. It also makes evidence-based recommendations for future directions of government capacity development and regulatory innovation.

Received: October 30, 2026 **Accepted:** November 02, 2026 **Published:** November 06, 2026

Citation: Proceedings of the 3rd Global Conference on Environmental Science and Technology (GEST - 2026). *USG Proc J* 2(Suppl 20): S1-S17.

Copyright: © 2026. This is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY) (http://creativecommons.org/licenses/by/4.0/) which permits commercial use, including reproduction, adaptation, and distribution of the article provided the original author and source are credited.